PHYS 251
General Physics II
4 Credits: (3 lecture hours, 1 recitation hour, and 3 laboratory hours)

Community College of Baltimore County
Common Course Outline

Description

PHYS 251 – General Physics II: is a course that introduces students to electricity and magnetism, kinetic theory, thermodynamics, thermal energy, and heat. It builds on PHYS 151 as the second course in a three-semester set of calculus-based courses in the basic principles of physics for students majoring in Engineering, Mathematics, or a physical science. The course requires knowledge of algebra, trigonometry, and calculus.

Pre-requisite: A grade of C or better in PHYS 151.

Overall Course Objectives

Upon completion of this course, students will be able to:

1. apply Coulomb's law of electrostatic force;
2. solve problems of force and motion in electric fields;
3. develop models of electric potential from energy and electrostatic force concepts;
4. analyze elementary Direct Current (DC) circuits with Ohm's relationship and Kirchhoff's rules;
5. apply the Lorentz magnetic force laws;
6. solve induction problems with Faraday's law and Lenz's law;
7. analyze series inductor-resistor-capacitor alternating current LR circuits (LRC) using Kirchhoff's rules;
8. solve problems related to energy and entropy;
9. derive relationships for the kinetic theory of gases;
10. use computer-based data collection methods;
11. use appropriate computer programs and software tools to plot and analyze data;
12. evaluate the results of experiments in terms of supporting or disproving theoretical concepts;
13. find, evaluate, use, and cite appropriate resources, including the accepted values of measured quantities;
14. write logically constructed laboratory reports;
15. evaluate professional behavior within the scientific community including the ramifications of misconduct;
16. properly acknowledge reference sources and others' contributions to collaborative work;
17. compare and contrast the role that physics has had within various cultures; and
18. describe the universal applicability of the laws of physics, making them the intellectual property of all humankind.

Major Topics

I. Electric charge and electric Fields
    a. Coulomb's law
    b. Electric field
    c. Gauss's law
II. Electric potential and electric energy
    a. Electrical potential
    b. Capacitance
    c. RC circuits
III. Electric current and DC circuits
    a. Current
    b. Resistance and Ohm's Relationship
    c. Series and parallel combinations
    d. Kirchhoff's rules
    e. Power
IV. Magnetism
    a. Magnets and the Earth's magnetic field
    b. Lorentz Force
    c. Magnetic fields of simple current configurations
    d. Ampere's law
    e. Magnetic effects and domains
V. Electromagnetic induction and alternating current
    a. Faraday's law
    b. Self-inductance
    c. Mutual inductance
    d. LR circuits
    e. AC circuits and resonance
VI. Maxwell's equations and electro-magnetic waves
VII. Temperature and heat
    a. Zeroth Law of Thermodynamics
    b. Thermal expansion of solids
    c. Mechanisms of thermal energy transfer
VIII. Thermal properties of matter
    a. Ideal gases
    b. Sensible heat and calorimetry
    c. Latent heat and phase changes
IX. First Law of Thermodynamics
    a. Work
    b. Internal energy
X. Second Law of Thermodynamics
    a. Entropy
    b. Heat engines
    c. Carnot cycle
XI. Global developments in Physics
XII. Universal application of Physics principles

Course Requirements

Grading will be determined by the individual faculty member, but shall include the following, at minimum:

- four proctored examinations (with limited, instructor-provided notes), one of which may be a comprehensive final, that count as 60% to 70% of the final grade
- six quizzes and/or homework problem sets that count as 10% to 15% of the final grade. Occasionally, department assessment tools may be administered; any credit for such assignments shall be included in this category
- 11 laboratory exercises with formal reports that count as 20% to 25% of the final grade
- any other assignments the instructor may require that count up to 10% of the final grade, for a total of 100%
- no more than 2% of the final grade can be earned extra credit
- attendance will be taken each class period as *per* college policy, but no points will be awarded or docked for attendance. However, assignments may be given that can only be completed within a certain class period.

Written assignments and research projects: Students are required to use appropriate academic resources in their research and cite sources according to the style selected by their professor.

Other Course Information

This course is an approved 4–credit General Education course in the Biological and Physical Sciences and fulfills the laboratory requirement.

One or more assignments will infuse CCBC General Education Program outcomes and will account for a minimum of 10% of the total course grade. The assignment(s) will allow students to demonstrate at least 5 of the 7 General Education program outcomes.

This course is the second of a three-course series, follows PHYS 151, and may be taken concurrently with PHYS 252.

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